



X0.2 Owner's Manual

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Introduction

The X0.2 is an ultra high quality three chassis line-stage audio pre-amplifier featuring remote control and internal power supply. It combines a completely new circuit topology with traditional construction representing thirty five years of preamplifier design.

This pre-amplifier flows from a commitment to create the best sounding product: a simple circuit with the most natural sonic characteristics. Derived from US Patent # 5,376,899, the X0.2 integrates power MOSFET and JFET devices in a simple Class A topology in order to deliver the finest sound possible.

The Super-Symmetric gain circuitry used in the X0.2 is unique in providing superior flexibility and performance with both balanced and unbalanced inputs and outputs, converting one to the other as desired without extra circuitry and without performance degradation.

The X0.2 minimizes the number of components in the signal path, and yet retains exemplary objective performance specifications. It pushes the edge of the art in exploring how much subjective quality is obtainable with a new but very elementary gain stage.

The X0.2 employs a patented new type of volume control that offers significantly better performance than seen before in an electronic control. It provides over 60 dB of range, large voltage swing and very good measured performance. The distortion and noise is at 1/10 and the dynamic range 100 times the previous state of the art in active attenuation. Most importantly it is subjectively outstanding; better than any potentiometer we have evaluated.

The fluorescent display is a very special device. Not only will you find its blue color highly attractive and readable, it is far more reliable than the usual LED or LCD display.

Very few people are involved in the production of this product. I supervise all phases of the construction, and I test each pre-amplifier myself. If you have questions, comments, or problems, please feel free to contact me directly.

Thank you for purchasing this pre-amplifier. It is my sincere hope that you will enjoy its sound as much as I do.

Wayne Colburn
Vice President, Design

Setup

The pre-amplifier consists of three machined aluminum chassis; it has five sets of input connections, two sets of outputs, both single-ended and balanced, a tape loop and a full function remote control unit that mirrors the front panel functions.

The power supply control chassis has a 5-way binding post that is used for remote amplifier turn-on. The pre-amplifier's voltage and current rating are indicated by the affixed tag on the bottom of the pre-amplifier's power supply control chassis. This tag will indicate either 240 volts, 220 volts, 120 volts, or 100 volts. A 0.5 amp 3AG slow blow fuse is provided with 100-120 volt units, and a 0.25 amp slow-blow fuse is provided with 220-240 volt units. The frequency rating of the X0.2 power supply is 50 to 60 Hz. This pre-amplifier typically draws 30 watts during operation. Please verify that the input power rating as indicated on your unit is consistent with that supplied in your area before attempting hook up.

The remote control is powered by two (2) factory installed AAA batteries.

The individual gain channels connect to the power supply control unit with four (4) necessary cables and to each other with one optional cable. **These cables must be installed before the preamp is powered up.** The cable jacks are clearly labeled on the rear of each chassis and are style and gender specific so as to minimize opportunity for mis-connection.

Both gain channels are identical electrically, the only difference is the color of the identifying rings under the RCA connectors. The right channel is identified by red rings under the RCA's connectors and the left by white rings. Additionally the right gain stage chassis has a female XLR marked "mono" and the left gain control chassis has a male XLR marked "mono" as a further identifier.

The X0.2 takes maximal advantage of four identical gain paths (two identical paths per channel) very much unlike the typical two gain path (one signal path per channel) pre-amplifier you may be familiar with. Almost without exception traditional consumer audio pre-amplifiers, unlike their science and industry counterparts have maintained a single signal path per channel (two identical paths in a stereo pair).

In order to manage balanced signals these two gain path pre-amplifiers must utilize phase combining networks to process incoming signals and subsequently drive outputs via phase splitting circuits to re-establish a quasi-balanced signal. This manipulation of

signal typically adds additional gain stages and degrades the inherent noise and distortion superiority of balanced signal, coloring what you eventually hear.

Pass Labs, through its unique patented “Supersymmetry” topology, maintains the advantages of a true balanced signal throughout the electronics chain. The salient point of this approach affords significantly less signal manipulation, higher input impedance, as much as a 100:1 (20dB) reduction in distortion while providing greater gain, and twice the dynamic headroom of identical circuits running single ended.

The X0.2 maintains the integrity of its received signal by treating all sources internally as balanced signals and converts seamlessly between balanced and unbalanced inputs and outputs without any additional components in the signal path. This was a conscious effort by Pass Labs to enhance the consumer’s ability to integrate source components and power amps with otherwise incompatible requirements through a virtually transparent control center.

It is not absolutely necessary to have the “mono” cable installed between these connectors unless you plan to operate the X0.2 in mono mode. You may use our supplied “mono” cable or an aftermarket male - female XLR of your choosing. If you choose an aftermarket cable, length should be consistent with the placement of your equipment and not excessively long.

The DIN connectors plug into their mating jacks and then screw into the rear panel on all three chassis. These connectors are intentionally a snug fit, but should never be forced. The single unmarked DIN jack on the right rear of the power supply control chassis is currently unused, we have reserved it for future performance enhancements.

We have provided a standard IEC AC power cord that fits into the IEC line receptacle at the rear of the pre-amplifier power chassis. The pre-amplifier is equipped for operation with an earth ground provided by the user’s AC outlet. Do not defeat this ground. The chassis and circuit ground of the pre-amplifier are connected to earth through a power thermistor, which gives a ground connection for safety but helps avoid ground loops.

As a safety issue we suggest that the power cord should be the last cable installed on your pre-amplifier. The power cord should be attached to the pre-amp power supply prior to plugging into “house power.”

There are a total of five inputs, a separate tape loop and two outputs on each of the pre-amplifier chassis. One chassis is exclusively dedicated to right channel and the other exclusively left channel. Balanced inputs and outputs are via XLR connectors. Single-ended inputs and outputs are via RCA connectors. On the XLR connectors, pin 1 is grounded, pin 2 is the positive signal, and pin 3 is the negative signal.

If your signal source is unbalanced, input will occur through the RCA input connectors, which are in parallel with the XLR connections. When single-ended inputs are used, a shorting jumper, which is provided, should be inserted between pins 1 and 3 of the corresponding XLR connection. The supplied jumpers short the negative input to ground, and provide for optimal performance. The X0.2 preamplifier will function without these jumpers, but gain will be lower and performance will not be optimal.

The unbalanced input impedance of the pre-amplifier is 10K Ohms. In balanced mode, the input impedance is higher, with a differential impedance of at least 20K Ohms.

Next to the inputs on the rear panel of the gain stages, the pre-amplifier offers tape inputs through both XLR and RCA connectors. This output is a direct connection to inputs 1, 2, 3, 4 and 5 when they are selected from the front panel. Input 6 (TAPE IN) is deliberately not available through the tape output connection. Tape input is designated for use with a tape recorder if you have one, and we have arranged that it will not place its output on the tape out, which will prevent you from accidentally creating a feedback connection with your tape machine.

The main outputs are located left-hand of center (viewed from the rear) of the rear panel, two male XLR connectors, and two RCA connectors. The RCA connectors' ground is in parallel with pin 1 of the XLR outputs, and the RCA hot is fed from an independent summing junction that maximizes the X circuit benefits. The RCA, single-ended, outputs are buffered from the balanced outputs.

In an effort to accommodate a wide range of equipment we have configured this product so that you may use both single ended and balanced outputs at the same time. On the XLR, pin 1 is ground, pin 2 is positive output, and pin 3 is negative output.

Description of Operation

In application the X 0.2's front panel controls and alphanumeric display are quite straight forward, and intuitive. We encourage you to become familiar with their operation prior to establishing any input connections with this unit. Experience indicates that engaging in a few minutes of exploration and playtime will add much to your ultimate enjoyment of this exceptional Pass Labs product.

The two front panel mode switches move the pre-amplifier and its display through 9 different functions. From virtual left to virtual right these functions are as follows: Volume, Input, Mute, Tape, Balance, Display, Mono, Unity, Amp (power-amplifier turn on/off control). Actuating the mode < switch moves the function to the feature immediately to the virtual left, and conversely actuating the mode > switch moves the function to the feature that is immediately to the virtual right.

The two Select switches (designated by up and down pointing arrows) then alter the displayed active function. The select arrows toggle the following functions either off or on (the up pointing arrow ^ representing "on" and the down pointing arrow v representing "off") Mute, Tape, Mono, and Amp.

The leftmost function as selected by the two mode switches is volume, and the up/down arrows select 72 steps incrementally, indicated on the fluorescent display as 0 - 71. A more traditional knob, located at the far right of the front panel, which is always active, exactly duplicates this control function. Each step is approximately 1 dB of incremental change.

The next mode to the right is the input selector, for inputs 1 through 5. Input 5 is unique in that it is linked with the Unity function. (The UNITY FUNCTION is discussed at length later in this manual.) The two select arrows (^ & v) logically control selections of the various inputs to the pre-amplifier.

The channel balance function is affected by the up and down arrows. The up arrow is balance right and the down arrow conversely balance left.

The display function chooses one of three iterations of brightness for the front panel fluorescent display. These choices of display brightness are selectable by the up/down arrows; they are bright, dim and off.

The unity function bears special attention. This control is associated only with input number 5 and has two positions selected with the

up/down arrows. The up arrow toggles to a straight through function with neither attenuation nor gain. This function is useful in that it allows the pre-amplifier to function as a unity buffer for use with components that best function with their own volume controls, such as surround processors. When the right-front and left-front outputs of the processor are routed through input 5 of the X0.2 (with the gain of the X0.2 set for Unity gain), the volume will be under full control of the processor and the X0.2's action will be totally transparent. When the user chooses Unity this sets the X0.2's gain to the straight through 0dB setting, regardless of how it was previously configured. When at "Unity" both left and right level controls on the X0.2 will have a displayed value of 54, and any previous balance settings will be lost. Both of these default conditions are intentional, and intended to make the most advantageous use of your source electronics. You may also set any of the four inputs to unity (0dB gain) by manually setting the volume of that input at 54.

Before selecting this option, it is imperative that the input device on input number 5 have its gain set to minimum. Failure to follow this precaution could result in a volume level intolerable to both ears, speakers and bank account. We trust that the remote control, with its four buttons that duplicate those of the preamp front panel will enable you to quickly select inputs and establish levels of output.

The rear mounted pair of five-way binding posts on the power supply / control unit are intended to actuate the remote on/off function of our own X series power amplifiers from the X0.2 front panel, or via the four button remote. When the preamp mode "Amp" is selected it allows the user to switch a nominal 12 volts DC at maximum draw of 50 milliamps to these binding posts. In some instances this voltage may have the ability to control products from other manufactures, but we by no means have a comprehensive listing of their compatible features. If you have questions about compatibility your service technician and dealer are an excellent source of information. This setting has no "default" condition, it maintains the last setting chosen by its user.

The remote control uses the same four-button system as the front panel controls, but in a slightly different physical configuration. The far left button is mode < left the far right button is mode > right. The top button is select ^ up and the bottom is select v down. The main chassis display shows the active function. The display has two brightness levels and off. If any control is used the display reverts to its dim setting. The off mode shows the display for about 7 seconds and then turns off.

The electronic volume control allows greater than 70 dB range and is driven by a micro-controller that reads the optical encoder which serves as a front panel volume control. In this manner tracking of the volume for the two balanced channels is possible with accuracy unavailable on any ordinary volume control, assuring precise level steps and high common mode rejection in balanced circuits. Wayne Colburn's exceptional volume control, in conjunction with the fluorescent display, give the user the ability to replicate volume levels with absolute accuracy in steps of roughly 1dB.

Product Philosophy

- 1) Circuit simplicity and a minimum number of components is a key element. The fewer parts in series with the signal path, the better. Adding more parts and gain stages may improve measured specs, but will seldom improve the perceived sonic quality or reliability of a product.
- 2) The characteristic of gain devices and their specific use is important. Individual variations in performance between like devices are important, as are differences in topological usage. All signal bearing devices contribute to the degradation, but there are some different characteristics that are worthy of attention. For example, smooth low order nonlinearities are additive in quality, bringing false warmth and coloration, while abrupt high order nonlinearities add harshness and false brightness.
- 3) Maximum intrinsic linearity is desired. This is the performance of the gain stages before feedback is applied. Experience suggests that feedback is a subtractive process; it removes information from the signal. In many older designs, poor intrinsic linearity has been corrected out by large application of feedback, resulting in loss of warmth, space, and detail. The trick is to get good performance without this excessive reliance on feedback.

The art of high-end audio design lies in the approach to combining these elements to get high reliability and simplicity, high quality measured performance, and high quality subjective performance. It takes imagination and hard work to get as much of these as possible at once without trading them off against each other.

Other Design Comments

We recommend the use of the balanced output mode where possible. It will retain the character of the input mode, but offers less distortion, less noise, more gain, and more voltage swing, without compromising the sound.

With balanced operation, the common mode rejection of the preamp reflects the intrinsic common mode rejection of the topology, the matching of the gain devices, and the matching of the attenuator channels. In this case we have been able to keep the total mismatch to about .1%, for a common mode rejection of greater than -60 dB.

The input system of the pre-amplifier will exhibit full common mode noise rejection with passive balanced sources, where the negative input is connected to ground at the source through the appropriate source impedance. This allows adaptation of unbalanced sources to balanced operation with passive cable connections in a manner that achieves the noise rejection of active balanced sources.

The use of a micro-controller allows all of the pre-amplifier functions to be repeatable and accurately controlled. The micro-processor only controls the operational functions of the pre-amplifier. At no time do any of the input or output signals come into contact with the digital control signals. The digital circuits are powered by a power supply that is completely separate and isolated from the analog supply. Should it ever be necessary to update the software that controls the functioning of the preamp, only the socketed micro-processor need be changed.

The analog power supply for the X0.2 consists of a toroidal power transformer delivering an unregulated +/- 45 volts which is then actively regulated before feeding passive filtering and powering the constant current sources which bias the gain stages. Each channel has its own regulation. The power supply noise reaching the circuit is on the order of one microvolt, and the little of that which gets through the circuit is differentially rejected at the output in a balanced system. The relays and control systems are regulated independently. All digital circuits receive their power from a separate toroid, which, like its analog counterpart, is also double regulated, and carefully filtered.

Muting relays, which delay connection during turn-on, additionally shut off the output when insufficient power supply is available to maintain regulation, thus guarding the output of the pre-amplifier. The pre-amplifier is designed to run constantly, and will exhibit optimum measured performance within about 10 hours of turn-on. For this reason a power switch is intentionally omitted.

The X0.2 consists of three machined aluminum chassis. Likewise, the remote control device is ensconced in its own palm sized aluminum chassis. All four chassis components are machined from solid aluminum material on computer controlled vertical milling machines. There are no sheet metal components in this product. All engraving is done by laser to make it easy to read and provide a durable and attractive finish.

X0.2 Specifications

All figures obtained after 1 hour warmup, with regulated 120 VAC power line. See manual notes about AC power line regulation.

Gain, Balanced	12 dB Bal in, Bal output
Gain, single-ended	12dB unbal in, unbal output
Freq. Response	-3 dB @ 2 Hz -3 dB at @ 100 kHz
Distortion @ 1KHZ	< .1 % THD, typ .003% @ 2v
Maximum Output	20 volts rms bal out 7 volts rms unbal out
Output Impedance	200 ohms unbalanced 750 ohms balanced
Input Impedance	10K ohm unbalanced 20K ohm balanced
CMRR	typ. -80 dB, 20 - 20kHz
Crosstalk	typ. -90 dB, 20 - 20kHz
Output Noise floor	< -110 dBV, 20 - 20kHz
Extl amp turn on	12 volts DC 50 mA continuous
Power Consumption	35 watts
Dimensions	17" W x 3.5"H x 13 "D each
Shipping Weight	70 pounds in packing carton, 3 units

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Warranty Information

Please check with the factory-authorized distributor in the country you are purchasing this product for specific warranty information.

All Pass Laboratories products purchased from an authorized Pass Laboratories dealer in North America are covered by a transferable, limited 3-year warranty. This warrantee includes all parts and labor charges incurred at the repair facility in addition to return shipping to the domestic customer, exclusive of subsequent damages. Damage due to physical abuse is specifically not covered under this warranty.

For this warranty to apply the customer is responsible for returning the product unmodified to the factory within the warranty period. The customer assumes all responsibility for shipping and insurance to the factory or a factory specified repair facility. The conditions and stipulations of this Pass Laboratories warranty only applies to units sold new in North America.

Non-North America customers should consult with their original Pass Labs dealer or distributor for warrantee repair instruction prior to contacting the factory or shipping product for repair.

Non-North American product must be returned to the country of origin for warrantee service. Foreign distributors are only required to offer warranty service on Pass Laboratories product that they have imported.

Please note: Conditions of warranty service and customer rights for product purchased outside the United States may vary depending upon the distributor and local laws. Please check with your local distributor for specific rights and details.

Any modifications to Pass Laboratories products that have not received written factory approval nullify all claims and void the warrantee. Should a modified product be returned to the factory for repair the owner will be required to pay all necessary charges for the repair in addition to those charges required to return the product to its original configuration.

In the case of safety issues, no product shall be returned to the customer without those safety issues being corrected to the most recent accepted standards.

Removal or alteration of original Pass Labs serial numbers voids the factory warranty. Product with altered or missing serial numbers will be suspected as counterfeit product.

Pass Laboratories will not repair or in any way indemnify any counterfeit or cloned product.

Pass Laboratories does not offer products in voltages intended for international markets either to authorized Pass Labs dealers or to third parties located in the United States or Canada.

**For your protection please
read the following:**

Water and moisture: Electrical devices should not be used near water (as per example, near a bathtub, washbasin, kitchen sink, laundry tub, wet basement or swimming pool). Care should be taken such that objects do not have the opportunity to fall, and that liquid is never spilled onto or into the device enclosure through openings.

Power Sources: An electrical device must be connected to a mains power source in strict accordance with the supplied product owner's manual. Please verify that the AC mains voltage specified in the product manual matches those requirements indicated on the unit and the AC voltage provided to your location by the power company.

Grounding: Adequate precautions should be taken so that the grounding provisions built into an electrical product are never defeated.

Power Cords: Pass Laboratories provides a power supply cord that meets all legislated requirements for the market in which the product was originally sold. If you choose to substitute an after-market product we urge you to choose one that is fully safety rated by the necessary local authority.

Power Cord Protection: Power supply cords should be routed so that they are not likely to be walked on, abraded, or pinched by items placed on or against them, paying particular attention to cords where they enter plugs or exit from a device. Never under any circumstance insert a cut or damaged power cord into a mains power socket.

Power and Signal: Cables should never be connected / disconnected with equipment powered up. Failure to heed this warning may damage or destroy equipment.

Ventilation: Power-amplifiers run hot, but you should be able to place your hands on them without discomfort. You must allow for this heat in installation, by providing for free air circulation around the product. Electronics should not be subjected to sources of excessive radiant heat. Excessive heat can shorten the life of the product and may cause the electronics to self-protect and shut down.

Servicing: To reduce the risk of fire, electrical shock or other injuries, the user should not attempt to service the device beyond that which is described in the operating instructions. All other servicing must be referred to qualified service personnel.